

Math 246, Review problems for Midterm I.

1. Find the limit $\lim_{x \rightarrow 3} \frac{x^2}{6-x^2}$. How close the input must be to 3 for the output to be within 0.01 of the limit?
2. Set up the limit computing the instantaneous rate of change of the quantity $b(t) = \frac{t}{2+3t}$ at the moment $t = 2$. Simplify this expression and compute the limit.
3. Find the derivative of $f(t) = t^3(3 - 2\sqrt[5]{t})$. What are the critical points of this function?
4. Find the derivative of $f(x) = \frac{x}{\sqrt{x^3+a^2}}$ assuming that a is a constant.
5. Find the derivative of $f(x) = e^{0.3x} \sin(2.7x + 3.5)$.
6. Find the second derivative of $f(x) = \ln(x^2 + 1)$. For which values of x the graph of $f(x)$ is concave up or down?
7. Find the equation of the tangent line to $y = \ln(x + 1)$ at $x = 1$.
8. Assume that $\ln(y - x) = 2y$. Find $\frac{dy}{dx}$ by implicit differentiation.
9. Assume that $x^3 + y^3 = 9$. Find $\frac{dy}{dt}$ when $x = 1$ and $\frac{dx}{dt} = -2$.
10. Find the tangent line to the curve $x \ln(y) = 2y \ln(x)$ at $x = 1$.
11. The concentration of a chemical in a lake at the moment of time t (time is measured in days) is given by $C(t) = \frac{t+1}{100(2+\cos(\pi t))}$. What is the rate of change of the concentration at the moment $t = 10$?
12. The position of a particle moving on the line is $s(t) = t^3 - 6t^2 + 9t - 4$ (time is positive and is measured in seconds; the position is measured in meters). What is velocity of the particle at $t = 2$? When the particle moves to the left and when it moves to the right?